Technical Disclosure Commons

Defensive Publications Series

September 27, 2018

DTC-TRIGGERED TELEMETRY IN CONNECTED VEHICLES

Michael Lui

DTC-TRIGGERED TELEMETRY IN CONNECTED VEHICLES

AUTHORS:
Michael Lui

ABSTRACT

The embodiments presented herein proposes a method of sending telemetry data based on diagnostic trouble codes (DTCs). Together with a feedback mechanism, telemetry data that is sent can be much more concise than traditional automobile bulk telemetry, thereby lessening the time required for a remote monitoring center or repair shop to perform failure analysis on the issue.

DETAILED DESCRIPTION

Diagnostic trouble codes (DTCs) are a mechanism for failure analysis in the automotive industry. When a car is taken to a repair shop, a technician may read the DTC information using an on-board diagnostics (OBD) scan tool. A DTC may include freeze frame data and extended data, which are collected when an issue occurs. Technicians will typically diagnose vehicular problems using this DTC information combined with their own experience. However, a DTC may offer limited information for failure analysis because the data (e.g., freeze frame data and extended data) is static. Given the trending of digitization and dynamic environments in automobiles, traditional usage of DTCs may become outdated as the digitization process may result in new modes of failure and other issues.

In addition, with over the air (OTA) delivery of DTC data, information can be delivered through a radio channel between an automobile, a remote monitoring center, and/or a repair shop. Embodiments presented herein propose a new scalable DTC mechanism that provides cost-effective data collection for failure analysis in order to pinpoint the issue and to lessen both visits and wait times at repair shops.

Telemetry is a different mechanism for failure analysis. Periodic data may be sent to a remote monitoring center for health monitoring as well as post-mortem analysis. While telemetry can provide more information, the information may not be specific to any particular issue, as the data is general purpose. For instance, a vehicle may collect ample amount of data ranging from acceleration and speed, braking, and tire air pressure, and the like. This data can be collected continuously and in near real-time by remote monitoring centers. Sometimes, the data that is collected is not processed immediately, but is saved for a post-mortem analysis. If the data is processed immediately, it may require a large amount of computing power to conduct a proper analysis.

During an uneventful drive, the collected data may not indicate that any particular issues have occurred; therefore, it is reasonable to assume that there is no urgent need to immediately analyze the collected data. However, when a real issue occurs or a DTC is generated (or is about to be generated), it may be beneficial to receive a prompt response from a monitoring center. Thus, it is important for a monitoring center to be able to prioritize the processing of certain collected data. Processing general-purpose telemetry data may be difficult, especially considering the time and bandwidth required to transmit the data from a vehicle to a monitoring center. Therefore, a different telemetry collection mechanism is needed to provide a prompt feedback of the issue as they occur (as indicated by DTC).

DTC-triggered telemetry (DTT) is a scalable mechanism that carries precise DTC-related data in a cost-effective manner for an OTA-based service system. Unlike other general purpose automotive telemetry, the telemetry generated by DTT is very much DTC-centric. Telemetry data generated in this manner may focus on the information that triggers the generation of a DTC. Upon receiving this DTC-related data, the monitoring center can perform a failure analysis immediately, with no filtering being necessary. The telemetry data is direct and can specifically pinpoint any DTCs that were generated. DTT employs an event monitor scheme and a flexible buffer pool on each DTC using a heuristic approach. The monitor scheme tracks all the events, logs, and statistical data related to each DTC in a flexible buffer pool. This buffer pool data may not send to the remote monitoring center under normal circumstances, thereby avoiding any unnecessary waste of cellular bandwidth.

When an issue occurs or is about to occur, depending on the configuration and watermark of the buffer pool, an appropriate amount of data (historical and current) may be sent together with the DTC to the remote center using OTA communication. As mentioned, this DTC-specific telemetry data not only carries the current data relating to an issue, but also contains historical data leading up to the issue. Historical data may provide a greater insight into the cause of a failure. Also, if DTT data is configured to be sent before a DTC is generated, it could prevent an issue from occurring in certain circumstances. Figure 1 depicts an example of a DTC-triggered telemetry environment.

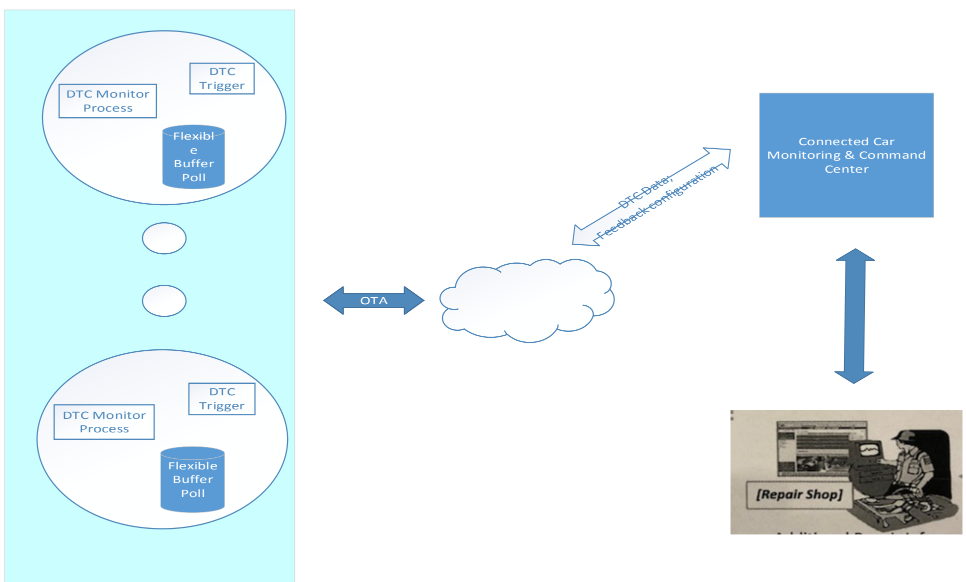

Figure 1

Configuration and watermarking of the flexible pool can be modified through a feedback mechanism so that when a DTC repeats or is about to repeat, different selections of data can be sent. For instance, instead of N intervals of historic data, it can be N ± M intervals. Or instead of sending data at watermark X, it may send at watermark Y. This mechanism offers a new paradigm for DTC by not only reporting issue with minimal data for failure analysis, but also by providing a scalable and flexible way to deal with detection and analysis of automobile failure in the future. Figure 2 depicts an example of a feedback mechanism in a DTC-triggered telemetry environment.

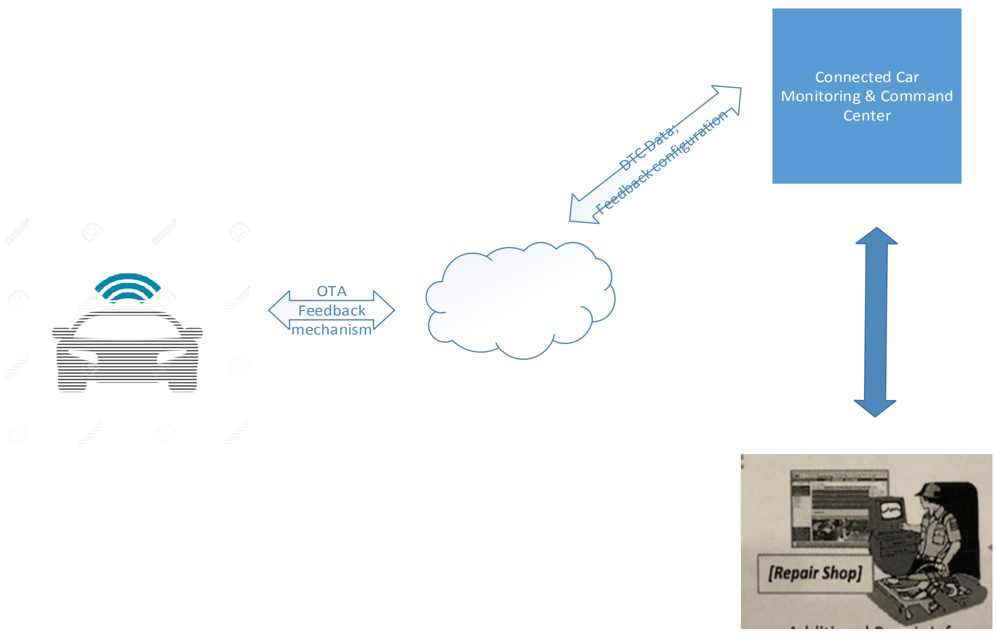

Figure 2